Claims

[c1] A process of depositing a ceramic coating on a surface of a component, the process comprising the steps of:
providing an evaporation source containing multiple different oxide compounds, at least one of the oxide compounds having a vapor pressure that is higher than the remaining oxide compounds;
suspending the component near the evaporation source;
projecting a high-energy beam on the evaporation source to melt and form a vapor cloud of the oxide compounds of the evaporation source while preventing the vapor cloud from contacting and condensing on the component during an initial phase in which the relative amount of the at least one oxide compound in the vapor cloud is greater than the relative amount of the at least one oxide compound in the evaporation source; and then
allowing the vapor cloud to contact and condense on the component to form the coating during a subsequent phase in which the relative amount of the at least one oxide compound in the vapor cloud is approximately equal to the relative amount of the at least one oxide compound in the evaporation source.

[c2] A process according to claim 1, wherein the vapor cloud is prevented from contacting and condensing on the component during the initial phase by placing a barrier between the component and the evaporation source, and the vapor cloud is allowed to contact and condense on the component during the subsequent phase by removing the barrier from between the component and the evaporation source.

[c3] A process according to claim 1, further comprising the step of preventing the vapor cloud from contacting and condensing on the component during a final phase in which the relative amount of the at least one oxide compound in the vapor cloud is lower than the relative amount of the at least one oxide compound in the evaporation source.

[c4] A process according to claim 1, wherein the at least one oxide compound is selected from the group consisting of ceria, magnesia, strontia, barium oxide, lanthana, neodymia, gadolinium oxide, dysprosia, ytterbia and tantala.

[c5] A process according to claim 4, wherein the evaporation source consists essentially of yttria, zirconia and the at least one oxide compound.

[c6] A process according to claim 5, wherein the at least one oxide compound is ceria.

[c7] A process according to claim 1, wherein the evaporation source consists essentially of yttria, zirconia and the at least one oxide compound.

[c8] A process according to claim 1, wherein the at least one oxide compound is ceria.

[c9] A process according to claim 1, wherein the evaporation source contains about 10 to about 20 weight percent ceria, the balance essentially zirconia stabilized by about 3 to about 8 weight percent yttria.

[c10] A process of depositing a thermal barrier coating on a surface of a gas turbine engine component, the process comprising the steps of:
depositing a bond coat on the component;
placing the component in a coating chamber containing a single ingot comprising zirconia, yttria and at least a third oxide compound having a vapor pressure that is at least an order of magnitude higher than zirconia and yttria; and then
projecting an electron beam on the ingot to melt and form a vapor cloud of zirconia, yttria and the third oxide compound while preventing the vapor cloud from contacting and condensing on the component during an initial phase in which the relative amount of the third oxide compound in the vapor cloud is higher than the relative amount of the third oxide compound in the ingot; and then
after the relative amount of the third oxide compound within the vapor cloud has dropped and then stabilized, allowing the vapor cloud to contact and condense on the component to form the thermal barrier coating and so that the third oxide compound is uniformly distributed in the thermal barrier coating in an amount approximately equal to the relative amount of the third oxide compound in the ingot.

[c11] A process according to claim 10, wherein after the amount of the third oxide compound within the vapor cloud has dropped and stabilized, the relative amount of the third oxide compound in the vapor cloud is approximately equal to the relative amount of the third oxide compound in the ingot.

[c12] A process according to claim 10, wherein the vapor cloud is prevented from contacting and condensing on the component during the initial phase by placing a barrier between the component and the ingot, and the vapor cloud is allowed to contact and condense on the component during the subsequent phase by removing the barrier from between the component and the ingot.

[c13] A process according to claim 10, further comprising the step of preventing the vapor cloud from contacting and condensing on the component during a final phase in which the relative amount of the third oxide compound in the vapor cloud is lower than the relative amount of the third oxide compound in the ingot.

[c14] A process according to claim 10, wherein the third oxide compound is selected from the group consisting of ceria, magnesia, strontia, barium oxide, lanthana, neodymia, gadolinium oxide, dysprosia, ytterbia and tantala.

[c15] A process according to claim 14, wherein the ingot consists essentially of yttria, zirconia and the third oxide compound.

[c16] A process according to claim 15, wherein the third oxide compound is ceria

[c17] A process according to claim 10, wherein the ingot consists essentially of yttria, zirconia and the third oxide compound.

[c18] A process according to claim 10, wherein the third oxide compound is ceria.

[c19] A process according to claim 10, wherein the ingot contains about 10 to about 20 weight percent ceria, the balance essentially zirconia stabilized by about 3 to about 8 weight percent yttria

[c20] A process according to claim 10, wherein the thermal barrier coating has a microstructure of columnar grains.

[c21] An apparatus for depositing a ceramic coating on a surface of a component, the apparatus comprising:
a single evaporation source containing multiple different oxide compounds, at least one of the oxide compounds having a vapor pressure that is higher than the remaining oxide compounds;
means for introducing the evaporation source into a coating chamber;
means for suspending the component near the evaporation source;
means for projecting a high-energy beam on the evaporation source to melt and form a vapor cloud of the oxide compounds of the evaporation source;
means for preventing the vapor cloud from contacting and condensing on the component during an initial phase in which the relative amount of the at least one oxide compound in the vapor cloud is greater than the relative amount of the at least one oxide compound in the evaporation source; and
means for removing the preventing means to allow the vapor cloud to contact and condense on the component to form the coating during a subsequent phase in which the relative amount of the at least one oxide compound in the vapor cloud is approximately equal to the relative amount of the at least one oxide compound in the evaporation source.

[c22] An apparatus according to claim 21, wherein the preventing means is a barrier positioned between the component and the evaporation source, and the removing means is operable to remove the barrier from between the component and the evaporation source.

[c23] An apparatus according to claim 21, wherein the at least one oxide compound is selected from the group consisting of ceria, magnesia, strontia, barium oxide, lanthana, neodymia, gadolinium oxide, dysprosia, ytterbia and tantala.

[c24] An apparatus according to claim 23, wherein the evaporation source consists essentially of yttria, zirconia and the at least one oxide compound.

[c25] An apparatus according to claim 24, wherein the at least one oxide compound is ceria.

[c26] An apparatus according to claim 21, wherein the evaporation source consists

essentially of yttria, zirconia and the at least one oxide compound.

[c27] An apparatus according to claim 21, wherein the at least one oxide compound is ceria.

[c28] An apparatus according to claim 21, wherein the evaporation source contains about 10 to about 20 weight percent ceria, the balance essentially zirconia stabilized by about 3 to about 8 weight percent yttria.

[c29] An EBPVD apparatus for depositing a ceramic coating on a surface of a component, the apparatus comprising:
a single ingot containing yttria-stabilized zirconia and at least one oxide compound having a vapor pressure that is at least an order of magnitude higher than yttria and zirconia;
means for introducing the ingot into a coating chamber;
means for suspending the component near the evaporation source;
means for projecting an electron beam on the ingot to melt and form a vapor cloud containing ions of yttria, zirconia and the oxide compound;
a barrier operable to be positioned between the ingot and the component to prevent the vapor cloud from contacting and condensing on the component during an initial phase in which the relative amount of the oxide compound in the vapor cloud is greater than the relative amount of the oxide compound in the ingot; and
means for removing the barrier to allow the vapor cloud to contact and condense on the component to form the coating during a subsequent phase in which the relative amount of the oxide compound in the vapor cloud is approximately equal to the relative amount of the oxide compound in the ingot.